CLAIMS

What is claimed is:

[c01] An apparatus for the rapid evaluation of a plurality of materials, the apparatus comprising:

a plurality of crystals operable for receiving an oscillating potential and oscillating, the plurality of crystals arranged in an array;

a plurality of oscillation devices operable for generating the oscillating potential, the plurality of oscillation devices arranged in an array;

means for measuring an output parameter each of the plurality of crystals;

means for setting a plurality of measurement parameters;

means for setting a plurality of control parameters; and

wherein the plurality of crystals are remotely coupled to the plurality of oscillation devices such that the plurality of crystals are exposed to a first operating environment and the plurality of oscillation devices are exposed to a second operating environment.

[c02] The apparatus of claim 1, wherein the plurality of measurement parameters comprise measurement parameters selected from the group consisting of total lines of data, number of points to average, trigger threshold, and integration time.

[c03] The apparatus of claim 1, wherein the plurality of control parameters comprise control parameters selected from the group consisting of flow rates of fluids delivered to the array of crystals, temperature, electromagnetic radiation, humidity, temporal profiles of fluid delivery, and temporal profiles of environmental conditions that affect the response of the crystals.

[c04] The apparatus of claim 1, further comprising one or more cables operable for coupling the plurality of crystals to the plurality of oscillation devices.

[c05] The apparatus of claim 1, further comprising one or more cables operable for remotely coupling the plurality of crystals to the plurality of oscillation devices.

[c06] The apparatus of claim 1, further comprising a time interval analyzer operable for determining when the means for measuring the output parameter for each of the plurality of crystals should measure the output parameter of each of the plurality of crystals.

[c07] The apparatus of claim 1, wherein the output parameter of each of the plurality of crystals comprises an output parameter selected from the group consisting of a fundamental oscillation frequency, a velocity of an acoustic wave, an attenuation of an acoustic wave, impedance phase and magnitude, conductance, and a capacitance change.

[c08] The apparatus of claim 1, wherein the means for measuring the output parameter each of the plurality of crystals measures the output parameter of each of the plurality of crystals in series.

[c09] The apparatus of claim 1, wherein the first operating environment and the second operating environment comprise predetermined temperature, pressure, chemical, and electromagnetic radiation environments.

[c10] The apparatus of claim 1, wherein the apparatus is used to detect material properties of interest, the material properties of interest comprising material properties selected from the group consisting of transition temperature, storage modulus, loss modulus, absorption, plasticization, crystallization, diffusion, permeation, barrier properties, physisorption, chemisorption, polymerization, and corrosion.

[c11] The apparatus of claim 1, wherein the apparatus is used to monitor film and particle deposition and removal from the plurality of crystals.

[c12] A method for enhancing the stability and the selectivity of each of a plurality of sensors of an array of sensors, the method comprising:

modulating each of the plurality of sensors of the array of sensors with respect to a predetermined parameter; and

wherein each of the plurality of sensors of the array of sensors comprises a material that is sensitive to a given environment such that when the sensor is exposed to the given environment a property of the material will change, measurably changing an output parameter of the sensor, and wherein the degree of change in the output parameter is correlated to the degree to which the given environment is present.

[c13] The method of claim 12, wherein each of the plurality of sensors of the array of sensors comprises a device selected from the group consisting of a thickness-shear mode (TSM) device, a surface acoustic wave (SAW) device, an acoustic plate mode (APM) device, a flexural plate wave (FPW) device, and a surface transverse wave (STW) device.

[c14] The method of claim 12, wherein the given environment comprises an environment selected from the group consisting of a temperature environment, a pressure environment, a chemical environment, and an electromagnetic radiation environment.

[c15] The method of claim 12, wherein the property of the material comprises the mass of the material.

[c16] The method of claim 12, wherein the property of the material comprises a viscoelastic property of the material.

[c17] The method of claim 12, wherein the output parameter of the sensor comprises an output parameter selected from the group consisting of a fundamental oscillation frequency, a velocity of an acoustic wave, an attenuation of an acoustic wave, impedance phase and magnitude, conductance, and a capacitance change.

[c18] The method of claim 12, wherein modulating each of the plurality of sensors of the array of sensors with respect to a predetermined parameter comprises modulating each of the plurality of sensors of the array of sensors with respect to sample flow rate.

[c19] The method of claim 12, wherein modulating each of the plurality of sensors of the array of sensors with respect to a predetermined parameter comprises modulating each of the plurality of sensors of the array of sensors with respect to sensor temperature.

[c20] The method of claim 12, wherein modulating each of the plurality of sensors of the array of sensors with respect to a predetermined parameter comprises modulating each of the plurality of sensors of the array of sensors with respect to a predetermined parameter utilizing a predetermined function.

[c21] The method of claim 20, where the predetermined function comprises a function selected from the group consisting of a step function, a square function, a saw function, and a sinusoidal function.

[c22] The method of claim 12, wherein modulating each of the plurality of sensors of the array of sensors with respect to a predetermined parameter comprises modulating each of the plurality of sensors of the array of sensors with respect to a predetermined parameter comprising a parameter selected from the group consisting of a change in the modulation period, modulation duty cycle, modulation waveform, modulation depth, and a modulation phase between several modulated parameters.

[c23] The method of claim 12, wherein modulating each of the plurality of sensors of the array of sensors with respect to a predetermined parameter comprises modulating each of the plurality of sensors of the array of sensors with respect to at least two predetermined parameters utilizing a predetermined function wherein the phase difference between the at least two predetermined parameters is changing as a function of time.

[c24] The method of claim 12, further comprising exposing a gas flow disposed around each of the plurality of sensors of the array of sensors to an analyte-removing source, the analyte-removing source creating a cleaned gas flow.

[c25] The method of claim 22, wherein the analyte-removing source comprises a corona discharge.

[c26] A method for the rapid evaluation of the extractability of materials from a plurality of samples, the method comprising:

providing a plurality of samples;

disposing the plurality of samples in a plurality of solvents for a first predetermined period of time;

providing a plurality of acoustic wave devices;

measuring a predetermined output parameter of each of the plurality of acoustic wave devices;

disposing the plurality of acoustic wave devices in the plurality of solvents for a second predetermined period of time;

removing the plurality of acoustic wave devices from the plurality of solvents;

measuring the predetermined output parameter of each of the plurality of acoustic wave devices; and

correlating the change in the predetermined output parameter of each of the plurality of acoustic wave devices to the extractability of materials from the plurality of samples.

[c27] The method of claim 26, further comprising arranging the plurality of samples in an array.

[c28] The method of claim 26, further comprising arranging the plurality of solvents in a array.

[c29] The method of claim 26, further comprising arranging the plurality of acoustic wave devices in an array.

[c30] The method of claim 26, wherein removing the plurality of acoustic wave devices from the plurality of solvents comprises evaporating the plurality of solvents;

[c31] The method of claim 26, wherein providing the plurality of acoustic wave devices comprises providing a plurality of acoustic wave devices selected from the group consisting of thickness-shear mode (TSM) devices, surface acoustic wave (SAW) devices, acoustic plate mode (APM) devices, flexural plate wave (FPW) devices, and surface transverse wave (STW) devices.

[c32] The method of claim 26, wherein measuring the predetermined output parameter of each of the plurality of acoustic wave devices comprises measuring an output parameter selected from the group consisting of a fundamental oscillation frequency, a velocity of an acoustic wave, an attenuation of an acoustic wave, impedance phase and magnitude, conductance, and a capacitance change.

[c33] The method of claim 26, wherein measuring the predetermined output parameter of each of the plurality of acoustic wave devices comprises measuring the predetermined output parameter of each of the plurality of acoustic wave devices simultaneously.

[c34] The method of claim 26, wherein the plurality of samples comprise a plurality of combinatorially-developed materials.

[c35] The method of claim 26, wherein the materials comprise low-molecular weight materials.

[c36] The method of claim 26, wherein the plurality of solvents comprise solvents selected from the group consisting of water, fuels, alkaline and acidic solutions, and organic solvents of different polarities.

[c37] The method of claim 26, further comprising identifying an extractable utilizing a mathematical analysis tool comprising a multivariate analysis tool selected from the group consisting of principal components analysis, neural networks analysis, partial least squares analysis, linear multivariate analysis, and nonlinear multivariate analysis.

[c38] A method for the rapid evaluation of the extractability of materials from a plurality of samples, the method comprising:

providing a plurality of samples, the plurality of samples arranged in an array;

disposing the plurality of samples in a plurality of solvents for a first predetermined period of time, the plurality of solvents arranged in an array;

providing a plurality of acoustic wave devices, the plurality of acoustic wave devices arranged in an array;

simultaneously measuring a fundamental oscillation frequency of each of the plurality of acoustic wave devices;

disposing the plurality of acoustic wave devices in the plurality of solvents for a second predetermined period of time;

evaporating the plurality of solvents;

simultaneously measuring the fundamental oscillation frequency of each of the plurality of acoustic wave devices; and

correlating the change in the fundamental oscillation frequency of each of the plurality of acoustic wave devices to the extractability of materials from the plurality of samples.

[c39] The method of claim 38, wherein providing the plurality of acoustic wave devices comprises providing a plurality of acoustic wave devices selected from the group consisting of thickness-shear mode (TSM) devices, surface acoustic wave (SAW) devices, acoustic plate mode (APM) devices, flexural plate wave (FPW) devices, and surface transverse wave (STW) devices.

[c40] The method of claim 38, wherein the materials comprise low-molecular weight material fractions.

[c41] The method of claim 38, wherein the plurality of solvents comprise solvents selected from the group consisting of water, fuels, alkaline and acidic solutions, and organic solvents of different polarities.

[c42] An apparatus for the rapid evaluation of the extractability of materials from a plurality of samples, the apparatus comprising:

a plurality of wells, the plurality of wells arranged in an array;

a plurality of samples and a plurality of solvents disposed within the plurality of wells, the plurality of samples and the plurality of solvents combining to form a plurality of solutions containing the materials;

a plurality of acoustic wave devices, wherein each of the plurality of acoustic wave devices comprises at least one surface operable for attracting at least one of the materials from the plurality of solutions, the plurality of acoustic wave devices arranged in an array;

means for measuring a predetermined output parameter of each of the plurality of acoustic wave devices; and

a correlation factor operable for correlating a change in the predetermined output parameter of each of the plurality of acoustic wave devices to the extractability of the materials from the plurality of samples.

[c43] The apparatus of claim 42, wherein the plurality of acoustic wave devices comprise a plurality of acoustic wave devices selected from the group consisting of thickness-shear mode (TSM) devices, surface acoustic wave (SAW) devices, acoustic plate mode (APM) devices, flexural plate wave (FPW) devices, and surface transverse wave (STW) devices.

[c44] The apparatus of claim 42, wherein the predetermined output parameter of each of the plurality of acoustic wave devices comprises an output parameter selected from the group consisting of a fundamental oscillation frequency, a velocity of an acoustic wave, an attenuation of an acoustic wave, impedance phase and magnitude, conductance, and a capacitance change.

[c45] The apparatus of claim 42, wherein the means for measuring the predetermined output parameter of each of the plurality of acoustic wave devices are

operable for measuring the predetermined output parameter of each of the plurality of acoustic wave devices simultaneously.

[c46] The apparatus of claim 42, wherein the plurality of samples comprise a plurality of combinatorially-developed materials.

[c47] The apparatus of claim 42, wherein the plurality of materials comprise additives selected from the group consisting of low-molecular weight material fractions.

[c48] The apparatus of claim 42, wherein the plurality of solvents comprise solvents selected from the group consisting of water, fuels, alkaline and acidic solutions, and organic solvents of different polarities.

[c49] The apparatus of claim 42, further comprising a plurality of electrodes coupled to the plurality of acoustic wave devices.

[c50] An apparatus for the rapid evaluation of chemical sensitivity properties of a plurality of materials, the apparatus comprising:

a plurality of crystals coated with materials of interest and operable for receiving an oscillating potential and oscillating, the plurality of crystals arranged in an array;

a plurality of oscillation devices operable for generating the oscillating potential, the plurality of oscillation devices arranged in an array;

means for measuring an output parameter of each of the plurality of crystals;

means for setting a plurality of measurement parameters;

means for setting a plurality of control parameters; and

wherein the plurality of crystals is remotely coupled to the plurality of oscillation devices such that the plurality of crystals are exposed to a first operating

environment and the plurality of oscillation devices are exposed to a second operating environment.

[c51] The apparatus of claim 50, wherein the plurality of measurement parameters comprise measurement parameters selected from the group consisting of total lines of data, number of points to average, trigger threshold, and integration time.

[c52] The apparatus of claim 50, wherein the plurality of control parameters comprise control parameters selected from the group consisting of flow rates of fluids delivered to the array of crystals, temperature, electromagnetic radiation, humidity, temporal profiles of fluid delivery, and temporal profiles of environmental conditions that affect the response of the crystals.

[c53] The apparatus of claim 50, wherein the output parameter of each of the plurality of crystals comprises an output parameter selected from the group consisting of a fundamental oscillation frequency, a velocity of an acoustic wave, an attenuation of an acoustic wave, impedance phase and magnitude, conductance, and a capacitance change.

[c54] The apparatus of claim 50, wherein the evaluation process of the chemical sensitivity properties is controlled automatically by a computer, wherein the computer commands desired concentrations of fluids to be delivered to the array of coated crystals.